

## ACTIVITY: WATERSHED WORDS OF WISDOM

### Overview

Fresh water is a precious, non-renewable resource that all people need and use. People depend on it for drinking, transportation, livelihoods, and recreation. Water also provides habitat for many plants and animals. Through the study of Virginia's watersheds, students will investigate and understand how being caring and responsible citizens can affect the quality and availability of water for all.

### Objectives

Students will be able to

1. describe, illustrate, and label a watershed;
2. develop a watershed vocabulary which includes scientific terms and geographical locations pertaining to the Virginia watersheds;
3. explain water's role in the social and economic development of the region;
4. understand how caring for local streams affects macroinvertebrates, fish, animals, people, and the Chesapeake Bay ecosystem;
5. identify 3 ways to protect and preserve water resources and demonstrate responsible actions to take care of our usable water supply.

### Background

When rain or snowmelt saturates the ground, the excess water becomes runoff that eventually collects in a stream channel, lake, reservoir, or other body of water. The collection area from where all this water drains is called the *drainage basin* or *watershed*. High elevation areas called *divides* or *ridgelines* separate watersheds. Irresponsible human actions can dramatically affect the natural balance of watersheds by causing unnecessary erosion from property development, destruction of wetlands, and overuse or contamination of the fresh water supply.



**SCIENCE:** Resources - Watersheds and Water Resources

**HISTORY AND SOCIAL SCIENCE:** Virginia Studies, Civics and Economics

**CHARACTER:** Responsibility, Caring

**GRADE LEVEL**  
4th and 6th Grades

#### VIRGINIA STANDARDS OF LEARNING

Science: 4.1, 4.5, 4.8, 6.1, 6.7, 6.9, ES.9  
English: 4.1, 4.2, 4.9, 6.1, 6.5, 6.7  
History and Social Science: CE.1, CE.4, VS.1

**LENGTH/DURATION**  
6 weeks or throughout the year

#### MATERIALS

large bulletin board or wall space, copies of the letters A-Z, entry blanks for suggested words, journals or portfolios, gallon jug, water, tablespoon, eyedropper, pH test kit and/or red cabbage juice, stream study equipment

#### VOCABULARY

watershed, drainage basin, runoff, ridgeline, macroinvertebrates, pH, acid, alkaline, neutral, pollution, wetlands, groundwater, abiotic, contaminated



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Pollution is an alteration in the character or quality of the environment that causes it to be less suited for life. Water pollution is caused when harmful chemical or waste materials are discharged or deposited directly into the water. Acid rain, fertilizers, animal waste, chemicals, and sediments from erosion can become harmful to the plants, animals, and people that depend on water for survival.

The quality or health of a body of water can be measured by investigating the water chemistry and the types of organisms living in the water. Oxygen content, pH, and mineral content are typical abiotic (non-living) factors that affect water chemistry. Contaminants

such as acid rain, factory emissions, and fertilizer runoff can alter water chemistry.



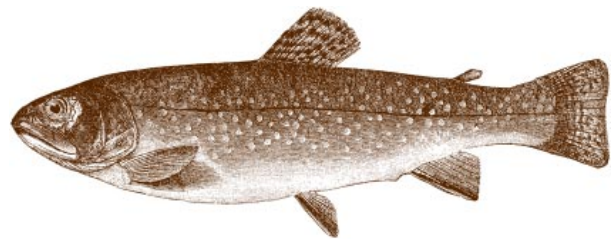
pH measures the relative *acidity*

(and *alkalinity*) of a substance. pH levels range from 0 (highly acidic) to 14 (extremely alkaline), with 7 being the neutral rating given to distilled water. Most plants and animals prefer a balanced or almost neutral pH level. Many animals are pollution “sensitive” and are unable to survive in either highly acidic or highly alkaline conditions. Mayflies, stoneflies, and caddisflies are *macroinvertebrates*, small animals without backbones, which require clean, uncontaminated water. Midge fly larvae, blackfly larvae, leeches, and snails are more “pollution-tolerant.” Many types of bacteria are also pollution-tolerant and can survive in either highly acidic or highly alkaline conditions.

Many types of water pollution can be cleaned up by using natural or man-made filtering systems and by reducing or eliminating the sources of pollutants that are released into the



environment. Healthy wetlands and buffer zones along the riverbanks are crucial to provide natural filters for some contaminants. Pollution control systems, new technology, energy conservation, and responsible personal habits can contribute to clean water and a healthy environment for the future.



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### LESSON

#### Motivational Activity

Watch and discuss the *National Geographic* video: *Water: A Precious Resource at Risk*.

Demonstrate the limited availability of usable, fresh water. Water covers approximately  $\frac{3}{4}$  of the earth's entire surface. Have students create a list of water sources: oceans, rivers, lakes, ponds, glaciers, polar icecaps, groundwater, and rain. Ask how much of that water is fresh water available for people to use.

Display a gallon jug (3.8 liters) of water. (This can be colored blue for a more dramatic effect). Explain that this gallon of water represents all the water on the Earth. Ask the students to estimate what portion of the gallon would represent salt water and how much would be fresh water. Pour out 2 tablespoons or use an eyedropper (1 fluid ounce or 30 milliliters) from the gallon jug and explain that this would represent the amount of fresh water available on earth. (For effect, pour the "fresh water" into an empty metal bucket.) Explain that most of this fresh water is frozen in glaciers and icecaps or is unavailable groundwater. Dramatically, take out one drop and put it in a cup. This visually represents all the fresh water that is in a form readily available for use.

Conclude that fresh water is a precious, limited resource. The amount of water available for human use depends not just on quantity, but also on its condition, or quality. Ask how this limited amount of available fresh water affects humans. Discuss ways people waste and misuse water and what people can do to help protect the water supply. Discuss

the responsibility individuals have to protect water resources for the health of the ecosystem and for people. Brainstorm ways students can help conserve and protect water resources.

The water in our environment today is the same water that was available to the dinosaurs millions of years ago. The process of purifying the limited amount of available fresh water for human use and consumption involves time, energy, and money. This use and consumption also has the potential to create new environmental problems as people divert water away from its initial source and use.

#### Activities

1. Create a "Watershed Words of Wisdom" display on a bulletin board or classroom wall. After each watershed activity, encourage students to add new words that they have learned to the word wall. Use A-Z letters to arrange the words alphabetically. Encourage the use of these words in discussions and written work.
2. Students should begin an ongoing journal or portfolio of their water studies. Include a list and usage of new vocabulary, illustrations, facts, explanations, and compiled, completed activities. As the research and study continue, students should express new insights, progressive levels of understanding, and desires to improve their "water world."
3. Introduce the term "watershed." To demonstrate how watersheds are separated by ridgelines, have the students interlock their fingers, palms up, to form a peak with their fingertips. Explain that when it

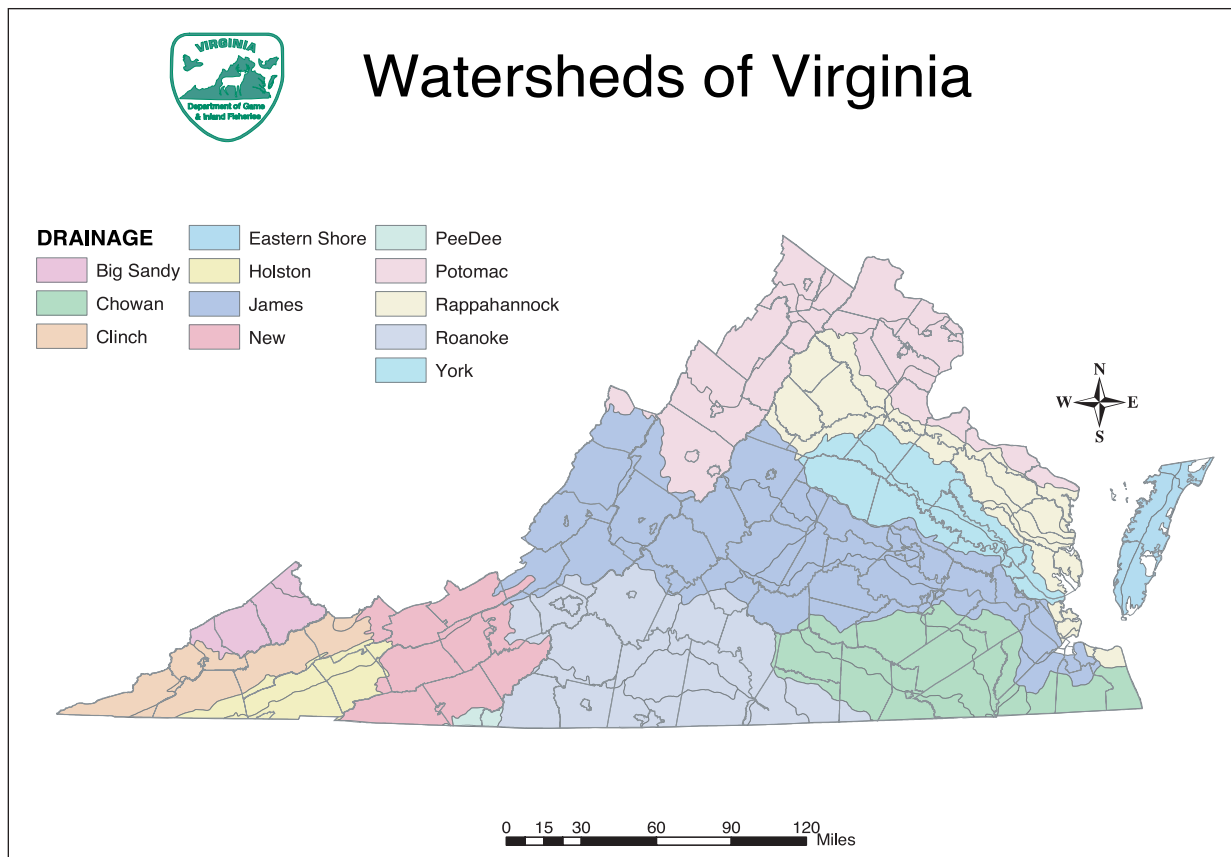
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rains the water will run off both sides of the ridge (fingertips) and into stream channels (between the fingers). Several streams may join together to form a drainage basin. Display and discuss a map or an illustration of a watershed. Have the students illustrate and label the watershed.

4. Use a Virginia map to discuss and color code the major Virginia river watersheds: Potomac-Shenandoah, Rappahannock, York, James, Roanoke, New, Tennessee-Big Sandy, and Chowan. The Virginia Department of Game & Inland Fisheries has watershed maps available at [www.dgif.state.va.us/education/watersheds.html](http://www.dgif.state.va.us/education/watersheds.html)

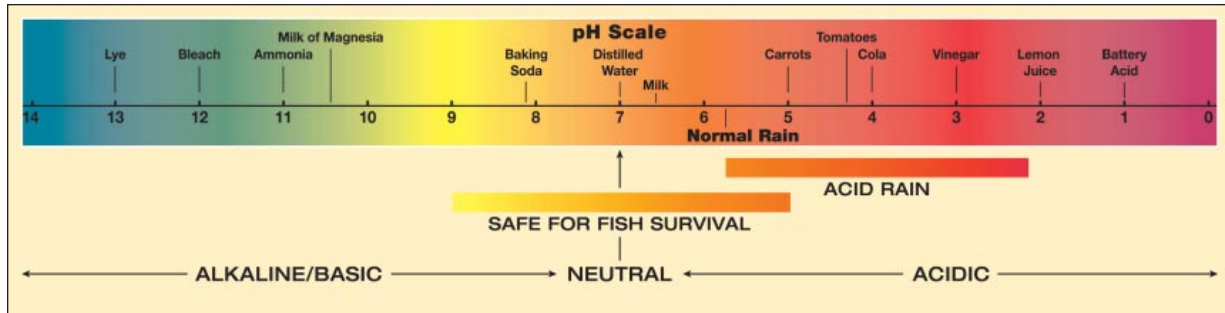
Have the students locate each watershed and determine each watershed's destination: the Chesapeake Bay, the Atlantic Ocean, or the Gulf of Mexico. Have the students determine which watershed they live within.

5. Have the students research the interwoven function water plays in the development, prosperity, and survival of communities and societies in a watershed, both past and present. Why is water so important to an area? How do people depend on water for jobs, transportation, food, and recreation? Have students illustrate and write about their discoveries.





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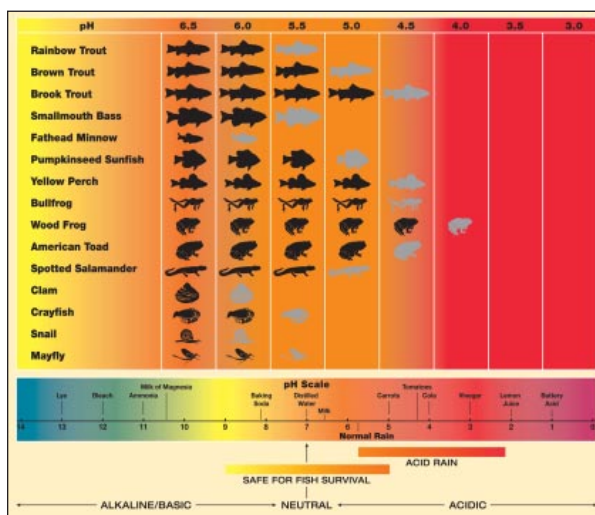


6. Test for the acidity and alkalinity of several sources of water: distilled, tap, stream, pond, and salt water, using red cabbage juice or a pH test kit. Cook red cabbage until it is tender and strain the juice into a jar. Add a few drops of the cabbage juice to the water sample to test the pH. The juice will turn bright pink when exposed to an acid (0-6 pH) and green or blue when exposed to an alkaline (8-14 pH). pH test kits provide the pre-made indicator solution and a color-coded chart. Gather data from each water source and develop a chart to compare pH information. Using a pH scale, create a hypothesis for the types of plants and animals that could survive in each sample.

7. Go on a stream study field trip. Using dip nets, magnifying lenses, buckets, and macroinvertebrate illustrations (see Resources and References), search for and identify macroinvertebrates in the stream. Test the pH of the stream. Based on the findings, have students determine the relative health and purity of the water. Demonstrate care and responsibility by carefully handling the living organisms and returning them to their natural environment. Upon return to the classroom, have students compile a list of animals found and write conclusions.



8. In the classroom, discuss how people can influence the quality of water and how human actions in one part of a watershed might impact others downstream. Consider the consequences of pollution, unplanned land development, acid rain, draining of wetlands, and overuse of water by a community. Discuss ways people can protect water resources.



Discuss the role that national parks play in protecting water resources. Use the Virginia watershed map from Activity 4 (above) to determine if any national park

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sites are located within the students' watershed. Do national parks have a responsibility to manage and protect water within the park boundaries? How do the parks protect those water resources? How do a park's actions affect people and habitats that depend on the water downstream in the watershed?

Ask the students to determine ways to conserve water, reduce pollution, and improve water quality at school, at home, and in their community. Discuss and write about how such actions demonstrate citizenship, caring for others, and stewardship.

### Assessments

1. Observe and document behavior, participation, and understanding exhibited in the classroom and in conversations.
2. Evaluate each individual's responsibility and contribution to the word wall.  
Suggested criteria for evaluation:  
20+ words = A  
15+ words = B  
10+ words = C
3. Create a rubric to evaluate the watershed map. Criteria would include correct labeling, responsibility in following directions, and effort.
4. Determine the level of understanding expressed in discussions and writings about the value water has in the development of surrounding areas.
5. Use the completed portfolio or journal entries as criteria for assessment of understanding and responsibility, effort, and content standards.



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### Going Further

1. Create a bulletin board display called “A Day in the Life of a Bay Animal.” Have students pretend they are a specific animal or plant that inhabits the Chesapeake Bay watershed. Students should first research an animal and then use personification to write about its characteristics, habitat, adaptations, and how pollution and disrespect for the environment affect its life. Writers should also try to persuade the reader to develop a caring attitude and to behave responsibly to protect and preserve the environment and water resources. Have students use words from the “Watershed Words of Wisdom” word wall, create illustrations, and share their stories.
2. Have students make a crossword puzzle using the “Watershed Words of Wisdom.” They should create the puzzle using the descriptions or definitions of the words. They can exchange with a friend to solve.
3. Build a model watershed for the classroom. See “Branching Out,” *Project Wet*.



4. Study the impact of pollution on a watershed. See “Sum of the Parts,” *Project Wet*.
5. Expand the stream study by testing the water chemistry using a dissolved oxygen test kit, thermometers, and water velocity tests. Combine with results of macroin-



vertebrate study to draw conclusions on the relative health of the stream.

6. “Adopt a Stream” near the school or in the community. Hold a stream cleanup day and help keep the stream clean during the school year. Sign your class (or school!) up for the Adopt-A-Stream Program at [www.dcr.state.va.us/sw/adopt.htm](http://www.dcr.state.va.us/sw/adopt.htm)
7. Utilize “A River Puzzle” available from the National Geographic website.

### Related Subject Activities

1. Social Studies - Participate in map studies of Virginia waterways.
2. Drama - Present the play “Life is One Big Adventure” featuring Sammy Stonefly and his friends (see Resources and References).
3. Language Arts - A variety of writing assignments can be used emphasizing issues relating to the watershed. Students can use vocabulary from the word wall in their essays and letters.



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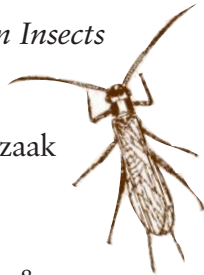
### Resources and References

Okay, Judy. *Life is One Big Adventure*.

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Kellogg, Loren Larkin. *Stream Insects and Crustaceans: Monitor's Guide to Aquatic Macroinvertebrates*. Izaak Walton League of America, 1994. 38-39.



Virginia Department of Game & Inland Fisheries, watershed maps, [www.dgif.state.va.us/education/watersheds.html](http://www.dgif.state.va.us/education/watersheds.html)

Sevebeck, Kathryn P, and Nancy L. Chapman, *Virginia's Waters*. Virginia Water Resources Research Center. Virginia: Virginia Polytechnic Institute and State University, 1989.

Homemade pH Indicators  
[www.mr-damon.com/experiments/6svt/ph\\_cabbage.htm](http://www.mr-damon.com/experiments/6svt/ph_cabbage.htm)

National Geographic Society Videos  
[www.nationalgeographic.com/education/teacher\\_store/index.html](http://www.nationalgeographic.com/education/teacher_store/index.html)  
*Geography Action! Rivers 2001*  
[www.nationalgeographic.com/geographyaction/rivers](http://www.nationalgeographic.com/geographyaction/rivers)

Izzak Walton League, Virginia Chapter  
*Save Our Streams* Water Quality Monitoring Program  
7598 North Lee Hwy  
Raphine, VA 24472  
888-656-6664  
[www.sosva.com](http://www.sosva.com)

Virginia Department of Environmental Quality  
[www.deq.state.va.us/water](http://www.deq.state.va.us/water)

Virginia Department of Conservation and Recreation  
*Adopt-A-Stream* Program  
203 Governor Street, Suite 206  
Richmond, VA 23219  
(804) 692-0148  
[www.dcr.state.va.us/sw/adopt.htm](http://www.dcr.state.va.us/sw/adopt.htm)

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*Project Wet*. The Watercourse and Western Regional Environmental Education Council, 1995 Edition.

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“A Drop in the Bucket.” 238-241,  
“Sum of the Parts.” 267-270.

Chesapeake Bay Program  
410 Severn Avenue, Suite 109  
Annapolis, Maryland 21403  
[www.chesapeakebay.net/index.cfm](http://www.chesapeakebay.net/index.cfm)  
[www.bayeducation.net](http://www.bayeducation.net)

